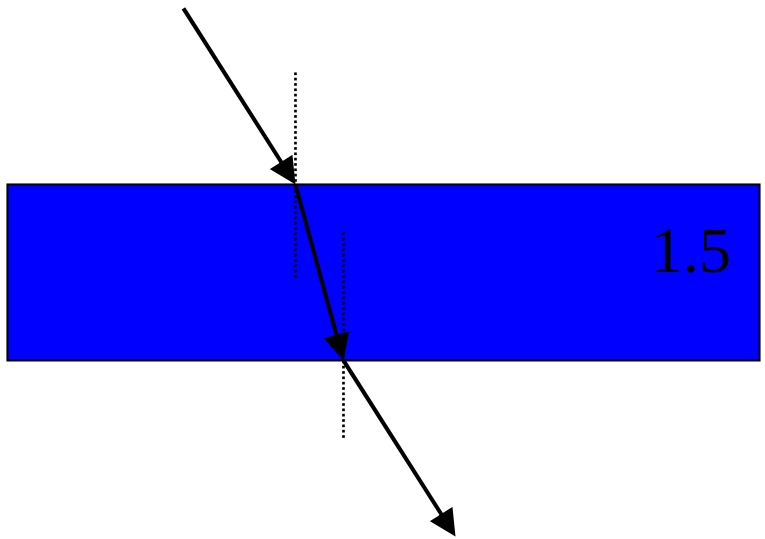
Consider a slab of material with thickness t = 2 cm with an index of refraction 1.5. If light is incident at an angle θ, show that the beam leaves parallel to itself on the other side of the slab at the same angle.

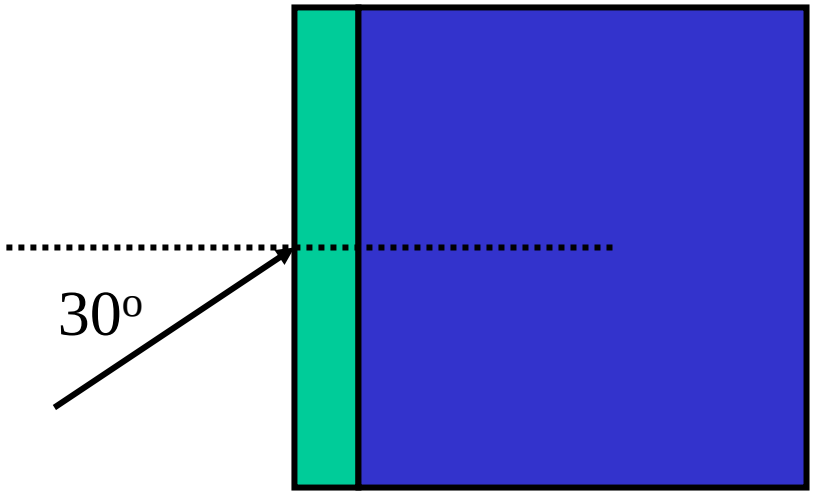


What is the speed of light in the medium?

What is the wavelength of light in air if the incident light has a frequency of 88.3 Mhz? In the medium?

How long does it take the wave to traverse the medium?

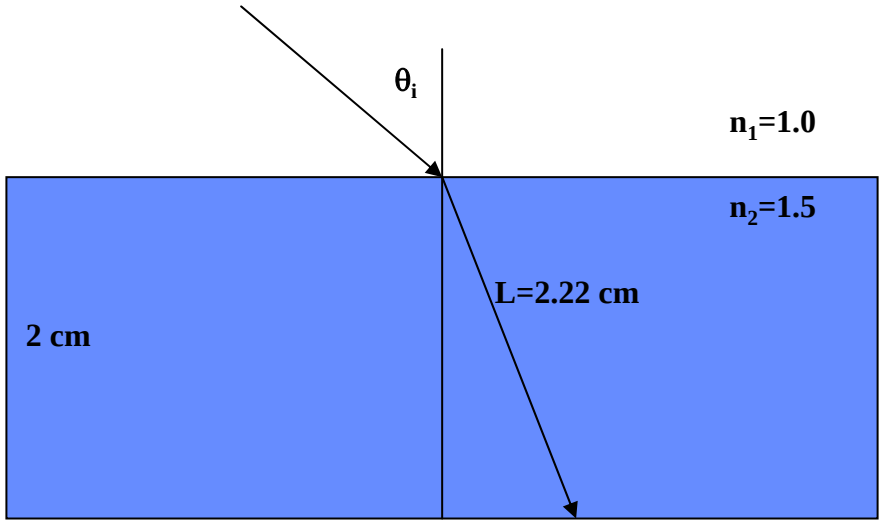
A narrow beam of light strikes the side of a piece of glass at an angle of 30° below the horizontal as shown below. If the glass has an index of refraction of 1.55, what is the angle of refraction for light in the glass?



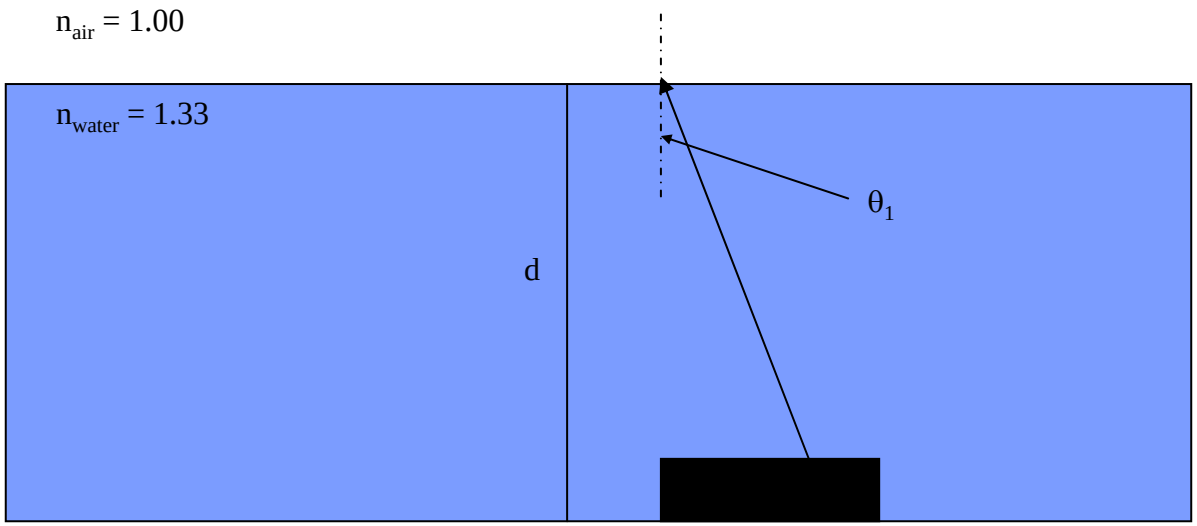
At what angle does the light enter the water?

If the glass wall is 5mm thick, how far will the beam be displaced from the location it was originally aimed?

If a beam of light takes 0.106 nanoseconds to travel the distance L = 2.22 cm as shown below, what is the angle of incidence that the beam makes with the surface?

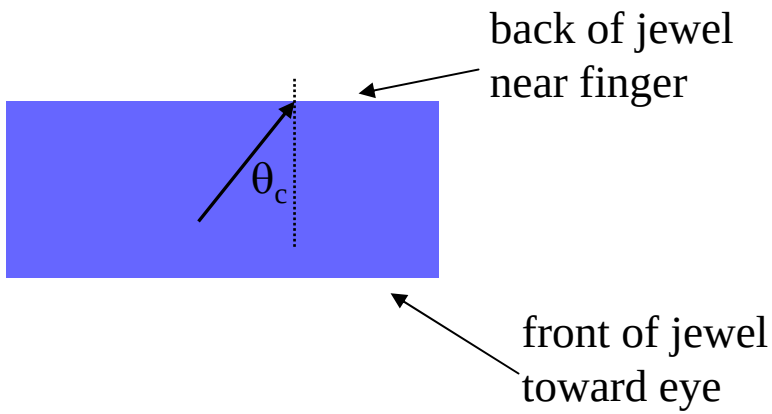


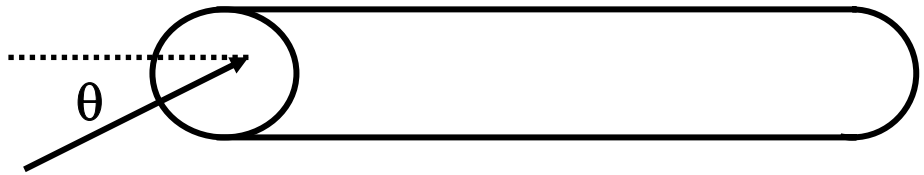
Where does the image of the box appear to be located, given the object is located a depth *d* below the surface and θ_1 is the angle of incidence of the ray with respect to the normal to the water-air surface?



What is the apparent depth, *d'*, of the box in terms of the actual depth, *d*, and the indices of refraction, n_{water} and n_{air}. (Hint: Use the fact that for small angles $\sin\theta \sim \tan\theta$, and use Snell's law.)

Many jewels are cut with many flat surfaces (or *facets*) to "catch the light" and give them their sparkle. Consider a blue sapphire (with index of refraction 1.77) and a ray of light that has entered the sapphire and is approaching some flat surface from inside (as shown below). What is the critical angle so that the light ray is totally internally reflected if the surrounding medium is air with an index of refraction 1.00?





What is the angle θ such that the light rays will be totally internally reflected? Assume that the pipe is n_{pipe} = 1.36.

An object is placed 5m to the left of a flat screen. If a converging lens with a focal length of 0.8m is placed between the object and the screen, what are the two possible object distances that will produce a sharp image on the screen?

For each object distance found, what are the corresponding image distances?

What are the properties and magnifications of each image?